



METHOD AND DETECTOR FOR IDENTIFYING SUBTYPES OF HUMAN PAPILLOMA VIRUSES

FIELD OF THE INVENTION

5 The present invention relates to a method and a detector for detecting human papilloma viruses, and more particularly to a method and a detector for simultaneously detecting and identifying subtype of human papilloma viruses.

BACKGROUND OF THE INVENTION

Cervical cancer is the most common cancer in women. The consorts are often men with
10 penile warts. Sexual activity appears to be an important predisposing factor of the epidemic disease and precancerous lesions. In early 5 to 10 years during the development of cervical cancer, cervical cells form cervical intraepithelial neoplasm.

Recently, in order to decrease the incidence of cervical cancer, Pap smear is used for the cervical cancer screening. However, the Pap smear has a false negative rate of about 30%~40%.
15 In addition, it is known that more than 95% of cervical carcinoma tissue contain detectable DNA sequences for known varieties of the human papilloma virus (HPV). Hence, the combination of Pap smear and HPV detection for the cervical cancer screening is considered.

The applicant cooperates with the hospital to did the epidemiology research in women cervical cancer by using Pap smear and HPV detection, wherein the HPV detection is proceeded
20 by using polymerase chain reaction and nucleotide sequencing. There are 2424 women aged from 16 to 84 for the epidemiology research, wherein 1963 women provide the effective specimen. The research results are shown as follows.

- 1) 1.9% (37/1963) of the women have abnormal cytological smears.
- 2) 12.7% (244/1926) of the women with normal cytological smears but have HPV infection.
- 25 3) The HPV prevalence in the women with abnormal cytological smears is 51.4% (19/37) and positively relative to the degree of the abnormal cytological smears, wherein the incidence of

abnormal non-typical squamous cells is 23.1%, the incidence of low abnormal epithelial cells is 41.7%, and the incidence of high abnormal epithelial cells is 75%.

4) The subtypes of human papilloma viruses detected in the specimens are HPV 52, HPV 58, HPV 70, HPV 16, HPV 18, HPV 68, HPV 33, HPV 66, HPV 35, HPV 37, HPV 54, HPV 59, HPV 67, HPV 72, HPV 69, HPV 82, HPV 39, HPV 31, HPV 32, HPV HLT7474-S, HPV 6, HPV CP8061, HPV 62, HPV CP8304, HPV 44, HPV 11, HPV 61, HPV 74, HPV 42 and HPV 43.

The conventional HPV detecting kits are only used for detecting 18 subtypes of human papilloma viruses including high risk HPV 16, HPV 18, HPV 31, HPV 33, HPV 35, HPV 39, HPV 45, HPV 51, HPV 52, HPV 56, HPV 58, HPV 59 and HPV 68, and detecting low risk HPV 6, HPV 11, HPV 42, HPV 43 and HPV 44.

According to the comparison of the epidemiology research and the conventional HPV detecting kits, various subtypes of human papilloma viruses contained in a specimen would not be identified by the conventional HPV detecting kits. In addition, the conventional HPV detecting kits are only used for detecting the high risk HPV and the low risk HPV, but not for identifying the HPV subtypes. Furthermore, the conventional HPV detecting kits lack the system control for checking the house-keep genes contained in a specimen.

In order to overcome the foresaid drawbacks of the conventional HPV detecting kits, the present invention provides a method and a detector for simultaneously detecting and identifying subtypes of human papilloma viruses contained in a sample.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a detector for simultaneously detecting and identifying subtypes of human papilloma viruses (HPV) contained in a sample.

In accordance with the present invention, the detector includes a carrier having a first part and a second part for carrying the sample thereon, a first oligonucleotide carried on said first part of the carrier, and a second oligonucleotide carried on the second part of the carrier, wherein the first and second oligonucleotides respectively hybridized with deoxyribonucleic acids contained

in a first subtype of human papilloma virus and a second subtype of human papilloma virus for simultaneously detecting and identifying subtypes of human papilloma viruses.

Preferably, the carrier is made of nylon.

Preferably, the carrier is a glass plate.

- 5 Preferably, the first and second subtypes of human papilloma viruses are respectively selected from 38 subtypes of human papilloma viruses, wherein the sequence of the first oligonucleotide is selected from one of the sequence group corresponding to the first subtype of human papilloma virus and complementary sequences thereof, and the sequence of the second oligonucleotide is selected from one of the sequence group corresponding to the second subtype of human
10 papilloma virus and complementary sequences thereof.

Preferably, the detector could be an oligonucleotide chip.

In another aspect of the present invention to provide a method for simultaneously detecting and identifying subtypes of human papilloma viruses contained in a sample.

- 15 In accordance with the present invention, the method includes steps of providing a first oligonucleotide and a second oligonucleotide for respectively hybridizing with a first and a second subtypes of human papilloma viruses, hybridizing deoxyribonucleic acid (DNA) contained in the sample with the first and second oligonucleotides, and removing nonhybridized DNA, thereby the subtypes of human papilloma viruses contained in the sample are detected and identified.

- 20 Preferably, the DNA contained in the sample is the product of polymerase chain reaction (PCR).

Preferably, the DNA contained in the sample has signaling substances labeled thereon.

Preferably, the signaling substance is biotin.

- 25 In addition, the method further includes a step of performing a reaction of biotin and avidin-alkalinephosphatase.

On the other hand, the signaling substances could be fluorescent substances. Preferably, the fluorescent substance is Cyanine 5.

It is another aspect of the present invention to provide a method for detecting a subtype of human papilloma viruses contained in a sample.

In accordance with present invention, the method includes steps of providing an oligonucleotide complementary to a sequence specific to the subtype of human papilloma viruses, hybridizing said oligonucleotide with deoxyribonucleic acid (DNA) contained in the sample, removing non-hybridized DNA contained in the sample, and detecting hybridized DNA to show whether the subtype of human papilloma viruses contained in the sample.

The present invention may best be understood through the following descriptions with reference to the accompanying drawings, in which:

10 BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic view showing the detector according to the first preferred embodiment of the present invention;

Fig. 2 is a schematic view showing the detector according to the second preferred embodiment of the present invention;

15 Fig. 3(a) is a schematic view showing the detector according to the third preferred embodiment of the present invention;

Fig. 3(b) is a schematic view illustrating the subtype of human papilloma viruses identified by each dot shown in Fig. 3(a);

20 Fig. 4(a) is the electrophoresis result showing the analyzed products of the first polymerase chain reaction;

Fig. 4(b) is the electrophoresis result showing the analyzed products of the second polymerase chain reaction;

Fig. 4(c) is detecting result on the detectors of detecting the HPV positive clones according to the third preferred embodiment of the present invention;

25 Fig. 5 is a view showing the detecting result on the detectors of detecting samples according to the third preferred embodiment of the present invention;

Fig. 6(a) is a schematic view showing the detector according to the fourth preferred embodiment of the present invention;

Fig. 6(b) is a schematic view illustrating the subtype of human papilloma viruses identified by each dot shown in Fig. 6(a);

5 Fig. 7(a) is a view showing the detector stained with SYBR Green II according to the fourth embodiment of the present invention; and

Fig. 7(b) is a view showing the detecting result on the detectors of detecting samples according to the fourth preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

10 Please refer to Fig. 1. A detector 10 is the first embodiment of the present invention for simultaneously detecting and identifying the subtypes of human papilloma viruses contained in a sample. The detector 10 includes a carrier 11 and a dot array. The carrier 11 is a nylon membrane having the dot array 12 mounted thereon. Each dot in the dot array 12 is an oligonucleotide (15~30mer) for identifying a specific subtype of human papilloma viruses.

15 The sequences of the oligonucleotides provided by the present invention are specific to the epidemics of human papilloma viruses. The sequences of the oligonucleotides shown in Tables 1 to 38 are determined by the way of comparing DNA sequences of 97 subtypes of human papilloma viruses. Each table illustrates a plurality of oligonucleotides for identifying a specific
20 subtype of human papilloma viruses.

METHOD AND DETECTOR FOR IDENTIFYING SUBTYPES OF HUMAN PAPILLOMA
VIRUSES

5 Table 1. Sequences and loci of oligonucleotides for identifying HPV 11

SEQ ID NO:	5' → 3'	Locus in HPV 11
SEQ ID NO:1	ATCTGTGTCTAAATC	6799 – 6813
SEQ ID NO:2	TCTGTGTCTAAATCTGCTAC	6800 – 6819
SEQ ID NO:3	ATCTGTGTCTAAATCTGCTACATACA	6799 – 6824
SEQ ID NO:4	TGCATCTGTGTCTAAATCTG	6796 – 6815
SEQ ID NO:5	AAATCTGCTACATACACTAA	6809 – 6828
SEQ ID NO:6	CTAAATCTGCTACATACACTA	6807 – 6827
SEQ ID NO:7	CTACATACACTAATTTCAGAT	6816 – 6835
SEQ ID NO:8	TAGCATTACATTATCTGCAGAAG	6895 – 6917
SEQ ID NO:9	TCCTTCTGTTTTGGAGGAC	6943 – 6961
SEQ ID NO:10	TTATATCGCCTCCACCAAATGGTACAC	6973 – 6998
SEQ ID NO:11	TTATAGATATGTACAGTCACAGGCC	7009 – 7033
SEQ ID NO:12	ACCCACACCTGAAAAAGAAAAAC	7048 – 7070
SEQ ID NO:13	GGCGGATGCTCATTATGCGACTG	1044 - 1066
SEQ ID NO:14	ATATGTAAGTCCTATAAGCAATGTAG	1101 - 1126
SEQ ID NO:15	CTAATGCAGTAGAAAGTGAGATAAGT	1127 - 1152
SEQ ID NO:16	CACGGTTAGACGCCATTAAACTTACA	1154 - 1179
SEQ ID NO:17	CACAGCCAAAAAAGGTAAAGCGACGG	1181 - 1206
SEQ ID NO:18	GCAACGCAGGTAGAGAAACATGGCGA	1264 - 1289
SEQ ID NO:19	GAAAATGGGGGAGATGGTCAGGAAAGGGAC	1294 - 1323
SEQ ID NO:20	GACACAGGGAGGGACATAGAGGGTGA	1321 - 1346
SEQ ID NO:21	ACATAGAGAGGCGGAAGCAGTAGACG	1356 - 1381
SEQ ID NO:22	ACAGCACCCGAGAGCATGCAGACACA	1382 - 1407
SEQ ID NO:23	TCAGGAATATTAGAATTACTAAAATG	1408 - 1433
SEQ ID NO:24	GCTGTCATTTGTTGATTTA	1482 - 1500

Table 2. Sequences and loci of oligonucleotides for identifying HPV 16

SEQ ID NO:	5' → 3'	Locus in HPV 16
SEQ ID NO:25	TATGTCATTATGTGCTGCCA	6659 – 6678
SEQ ID NO:26	GTGCTGCCATATCTACTTCA	6670 – 6689
SEQ ID NO:27	TGCCATATCTACTTC	6674 – 6688
SEQ ID NO:28	TATCTACTTCAGAACTACA	6679 – 6698
SEQ ID NO:29	CTACTTCAGAACTACATATAA	6682 – 6703

SEQ ID NO:30	ATAAAAATACTAACTTTAAG	6700 – 6719
SEQ ID NO:31	CAAAATAACCTTAAGTGCAGACG	6773 – 6795
SEQ ID NO:32	TTCCACTATTTTGGAGGAC	6821 – 6839
SEQ ID NO:33	TCTACAACCTCCCCCAGGAGGCACAC	6851 – 6876
SEQ ID NO:34	TTATAGGTTTGTAAACCCAG	6887 – 6905
SEQ ID NO:35	ACATACACCTCCAGCACCT	6923 – 6941
SEQ ID NO:36	CCTTAAAAAATACACT	6956 – 6971
SEQ ID NO:37	AGCAAAACAACATAGAGATGCAG	1089 - 1111
SEQ ID NO:38	ACTTAGTGATATTAGTGGATGTGTAG	1145 - 1170
SEQ ID NO:39	TAGTCCTAGATTAAAAGCTATATGTATAGA	1181 - 1210
SEQ ID NO:40	GAAAAACAAAGTAGAGCTGCAAAAAG	1209 - 1234
SEQ ID NO:41	CTCAGCAGATGTTACAGGTAGAAGGG	1285 - 1310
SEQ ID NO:42	CCATGAGACTGAAACACCATGTAGTC	1313 - 1338
SEQ ID NO:43	GGGGGTGGTTGCAGTCAGTACAGTAG	1356 - 1381
SEQ ID NO:44	GTGGGGGAGAGGGTGTAGTGAAAGA	1387 - 1412
SEQ ID NO:45	CTATATGCCAAACACCACTTACAAAT	1417 - 1442
SEQ ID NO:46	GTTATACGGGGTGAGTTTTTCAGAAT	1502 - 1527

Table 3. Sequences and loci of oligonucleotides for identifying HPV 18

SEQ ID NO:	5' → 3'	Locus in HPV 18
SEQ ID NO:47	TTCTACACAGTCTCC	6650 – 6664
SEQ ID NO:48	CAGTCTCCTGTACCTGGGCA	6657 – 6676
SEQ ID NO:49	AGTCTCCTGTACCTGGGCAA	6658 – 6677
SEQ ID NO:50	TCTCCTGTACCTGGGCAATATGA	6660 – 6682
SEQ ID NO:51	CTGTACCTGGGCAATATGAT	6664 – 6683
SEQ ID NO:52	ATGATGCTACCAAATTTAAG	6679 – 6698
SEQ ID NO:53	TACTATTACTTTAACTGCAGATG	6752 – 6774
SEQ ID NO:54	TAGCAGTATTTTAGAGGAT	6800 – 6818
SEQ ID NO:55	TGTTCCCCCCCCCACTACTAGTT	6830 – 6855
SEQ ID NO:56	ATATCGTTTTGTACAATCTGTT	6866 – 6887
SEQ ID NO:57	GGATGCTGCACCGGCTGAA	6905 – 6923
SEQ ID NO:58	CTATGATAAGTTAAAG	6935 – 6950
SEQ ID NO:59	GGTCCACAATGATGCACAAGTGT	1135 - 1157
SEQ ID NO:60	CACAGAAAACAGTCCATTAGGGGAGC	1192 - 1217
SEQ ID NO:61	GCTGGAGGTGGATACAGAGTTAAGTC	1219 - 1244
SEQ ID NO:62	AGTGGGCAGAAAAAGGCAAAAAGGCGGCTG	1271 - 1300
SEQ ID NO:63	CACAGATTCAGGTAACCTACAAATGGC	1347 - 1372
SEQ ID NO:64	CAATGTATGTAGTGGCGGCAGTACGG	1384 - 1409
SEQ ID NO:65	GACAACGGGGGCACAGAGGGCAACAA	1418 - 1443
SEQ ID NO:66	GTAGACGGTACAAGTGACAATAGCAA	1451 - 1476
SEQ ID NO:67	CCACAATGTACCATAGCACAATTAAA	1493 - 1518

SEQ ID NO:68	CACATATGGGCTATCATTTACAGATT	1573 - 1598
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Table 4. Sequences and loci of oligonucleotides for identifying HPV 26

SEQ ID NO:	5' → 3'	Locus in HPV 26
SEQ ID NO:69	TAGTACATTATCTGCAGCAT	6619 - 6638
SEQ ID NO:70	ATTATCTGCAGCATC	6625 - 6639
SEQ ID NO:71	TGCAGCATCTGCATCCACTC	6631 - 6650
SEQ ID NO:72	GCATCTGCATCCACTCCATTAAA	6635 - 6658
SEQ ID NO:73	CTCCATTAAACCATCTGAT	6648 - 6667
SEQ ID NO:74	TAAAATAAACTTACAACAGATG	6727 - 6749
SEQ ID NO:75	TGCCTCCATATTGGAGGAT	6775 - 6793
SEQ ID NO:76	ACTAACCTTACCTCCCCTGCTAGTT	6805 - 6830
SEQ ID NO:77	CTATAGGTTTATTAAAACTCT	6841 - 6862
SEQ ID NO:78	TAACGCCCTCCTGTGCCA	6880 - 6898
SEQ ID NO:79	AAAACAGGCAAATACAAAGGCAG	1093 - 1115
SEQ ID NO:80	CTAGGTAGTCAGAACAGCCCGTTGCA	1139 - 1164
SEQ ID NO:81	GCGACAGTCAGCAGAATACACACCAAGTAA	1194 - 1223
SEQ ID NO:82	CAAAAGGAGAGCCGTGGACAGTGTAC	1237 - 1262
SEQ ID NO:83	CCGTACAGGTAGATAACAATATGAA	1305 - 1330
SEQ ID NO:84	GCCTAGTGTGTGTAGTCAGGGGGGG	1345 - 1369
SEQ ID NO:85	GCCTCAGTGGAAGATATCGATGTAGA	1376 - 1401
SEQ ID NO:86	CAGTGTTACACAAATATGTGAATTAT	1414 - 1439
SEQ ID NO:87	CAGTATATGGTGTAAAGTTTTGCAGAA	1485 - 1510

Table 5. Sequences and loci of oligonucleotides for identifying HPV 31

SEQ ID NO:	5' → 3'	Locus in HPV 31
SEQ ID NO:88	TGCAATTGCAAACAG	6592 - 6606
SEQ ID NO:89	GCAATTGCAAACAGTGATAC	6593 - 6612
SEQ ID NO:90	CAATTGCAAACAGTGATACT	6594 - 6613
SEQ ID NO:91	GCAAACAGTGATACTACATTAA	6599 - 6621
SEQ ID NO:92	CTACATTTAAAAGTAGTAAT	6612 - 6631
SEQ ID NO:93	CAAAATAACATTATCTGCAGACA	6691 - 6713
SEQ ID NO:94	TCCTGCTATTTTGGAAGAT	6739 - 6757
SEQ ID NO:95	ATTGACCACACCTCCCTCAGGTTCTT	6769 - 6794
SEQ ID NO:96	CTATAGGTTTGTACCTCACAG	6805 - 6826
SEQ ID NO:97	AACTGCCCCCAAAGCCC	6844 - 6862
SEQ ID NO:98	AGCGGAGGAACATGCAGAGGCTG	1083 - 1105
SEQ ID NO:99	TTAAGTGATATTAGTAGTTGTGTGG	1140 - 1165
SEQ ID NO:100	AGTCCACGGTTAAAAGCTATATGCATAGAA	1177 - 1206
SEQ ID NO:101	GACTCTTTGAACTTCCAGACAGCGGG	1232 - 1257

SEQ ID NO:102	GCAGCAGATGGTACAGGTAGAGGAGC	1281 - 1306
SEQ ID NO:103	AATGGTAGTGACGGGACACATAGTGA	1327 - 1352
SEQ ID NO:104	CCAACACGTAATATATTGCAAGTGTT	1369 - 1394
SEQ ID NO:105	GCAATGGTAAAGCTGCTATGTTAGGT	1403 - 1428
SEQ ID NO:106	TTATATGGTGTAAGTTTATGGAAC	1441 - 1465

Table 6. Sequences and loci of oligonucleotides for identifying HPV 32

SEQ ID NO:	5'→3'	Locus in HPV 32
SEQ ID NO:107	TGCTACTGTAACAACTGAAG	6906 - 6925
SEQ ID NO:108	GCTACTGTAACAACTGAAGA	6907 - 6926
SEQ ID NO:109	TACTGTAACAACTGA	6909 - 6923
SEQ ID NO:110	ACTGTAACAACTGAAGACAC	6910 - 6929
SEQ ID NO:111	CAACTGAAGACACATACAAGTC	6917 - 6938
SEQ ID NO:112	CAAAATTACATTATCTGTAGAGG	7005 - 7027
SEQ ID NO:113	TCCTGACATACTAGACGAT	7053 - 7071
SEQ ID NO:114	TGTAGCTCCACCGCCCTCTGGTACTT	7083 - 7108
SEQ ID NO:115	TTATAGATTTGTGTCAGTCTCAG	7119 - 7140
SEQ ID NO:116	TAAGGTAACAGCACCTGAA	7158 - 7176
SEQ ID NO:117	TTTTTCTGACTATTCA	7188 - 7203
SEQ ID NO:118	AGCACATGCAGATAAGGAGGCAG	1062 - 1084
SEQ ID NO:119	GGCAGTCCATATGAAAGTCCCGCCAGTGAT	1111 - 1140
SEQ ID NO:120	GAGCTAAGCCCTAGGCTTGGTGGATT	1162 - 1187
SEQ ID NO:121	GGGGCCAAACGACGACTATTTCATC	1210 - 1235
SEQ ID NO:122	GCAGGAACAGGTAGAAAATGGACATG	1284 - 1309
SEQ ID NO:123	GTGTACATGGGGTGCAGGAAAATCAG	1352 - 1377
SEQ ID NO:124	GCCTACAACAAGGGTGGTGAATTGC	1395 - 1420
SEQ ID NO:125	GCAAGCAACATTGTTAGGTAAGTTTA	1437 - 1462
SEQ ID NO:126	GCTGTTTGGATTGTCATTTGGTGATT	1467 - 1492

Table 7. Sequences and loci of oligonucleotides for identifying HPV 33

SEQ ID NO:	5'→3'	Locus in HPV 33
SEQ ID NO:127	TATGCACACAAGTAACTAGT	6624 - 6643
SEQ ID NO:128	CACACAAGTAACTAG	6628 - 6642
SEQ ID NO:129	ACAAGTAACTAGTGACAGTA	6631 - 6650
SEQ ID NO:130	GTAAGTAGTGACAGTACATATAA	6635 - 6657
SEQ ID NO:131	GTACATATAAAAATGAAAAT	6648 - 6667
SEQ ID NO:132	CAAAGTTACCTTAACTGCAGAAG	6727 - 6749
SEQ ID NO:133	TCCAGATATTTTAGAAGAT	6775 - 6793
SEQ ID NO:134	TTTAACACCTCCTCCATCTGCTAGTT	6805 - 6830
SEQ ID NO:135	CTATAGGTTTGTACCTCTCAG	6841 - 6862

SEQ ID NO:136	AACAGTACCTCCAAAGGAA	6880 – 6898
SEQ ID NO:137	CTTAGGTAAATATACA	6910 – 6925
SEQ ID NO:138	AGGGGAGGATGATTAAATGCTG	1100 - 1122
SEQ ID NO:139	GCATGTTACAAAGTGCTGCGGAGGA	1149 - 1174
SEQ ID NO:140	GATCGTGCTGCAAACCCGTGTAGAAC	1182 - 1207
SEQ ID NO:141	GAATGCACATACAGAAAACGAAAAATAGAT	1227 - 1256
SEQ ID NO:142	AAATAGATGAGCTAGAAGACAGCGGA	1249 - 1274
SEQ ID NO:143	GGTACAACAGGTAGAAAGTCAAAATG	1307 - 1332
SEQ ID NO:144	GACTTAGAATCTAGTGGGGTGGGGGA	1350 - 1357
SEQ ID NO:145	CTGTGAGACAAATGTAGATAGCTGTG	1391 - 1416
SEQ ID NO:146	CGTTGCAGGAAATTAGTAATGTTCTA	1426 - 1451
SEQ ID NO:147	GAGGCCTATGGAATAAGTTTTAT	1494 - 1516

Table 8. Sequences and loci of oligonucleotides for identifying HPV 35

SEQ ID NO:	5' → 3'	Locus in HPV 35
SEQ ID NO:148	TCTGCTGTGTCTTCTAGTGA	6612 – 6631
SEQ ID NO:149	TGCTGTGTCTTCTAG	6614 – 6628
SEQ ID NO:150	GTGTCTTCTAGTGACAGTAC	6618 – 6637
SEQ ID NO:151	CTTCTAGTGACAGTACATATAAA	6622 – 6644
SEQ ID NO:152	GTACATATAAAAATGACAAT	6634 – 6653
SEQ ID NO:153	TAAAATAACACTAACAGCAGATG	6713 – 6735
SEQ ID NO:154	CCCGTCCATTTTAGAGGAT	6761 – 6779
SEQ ID NO:155	CCTTACACCACCGCCTTCTGGTACCT	6791 – 6816
SEQ ID NO:156	ATATCGCTATGTAACATCACAG	6827 – 6848
SEQ ID NO:157	ACCCAGTGCACCAAAACCT	6866 – 6884
SEQ ID NO:158	GGAGCAAACACACAAAGAGGCTG	1089 - 1111
SEQ ID NO:159	GCAGCGTGAGCTTATGTGTTAATAATAACA	1151 - 1180
SEQ ID NO:160	GTCCACGTTTAAAAGCTATTTGCA	1184 - 1207
SEQ ID NO:161	CGATTATTTGAACTACCAGACAGCGG	1237 - 1262
SEQ ID NO:162	GAGATACAACAGGTAGAGGGGCATGA	1291 - 1316
SEQ ID NO:163	GGGCAGTGGGGATAGTATAACCTCTA	1338 - 1363
SEQ ID NO:164	GACATGATGAGACTCCAACGCGAGAC	1376 - 1401
SEQ ID NO:165	CTAAAATGTAGTAATGCAAACGCAGC	1414 - 1439
SEQ ID NO:166	GCTATGTTGGCTAAATTTAAAGAACT	1438 - 1463

Table 9. Sequences and loci of oligonucleotides for identifying HPV 37

SEQ ID NO:	5' → 3'	Locus in HPV 37
SEQ ID NO:167	TGTCTACTGACAATG	6782 – 6796
SEQ ID NO:168	TGTCTACTGACAATGGCGAA	6782 – 6801
SEQ ID NO:169	TGACAATGGCGAAGTTACAG	6789 – 6808

SEQ ID NO:170	GACAATGGCGAAGTTACAGA	6790 – 6809
SEQ ID NO:171	AATGGCGAAGTTACAGAATA	6793 – 6812
SEQ ID NO:172	CAGAATATAATTCTCAAACA	6806 – 6825
SEQ ID NO:173	TAAAGTTCCTTTAAAGGCTGAGG	6885 – 6907
SEQ ID NO:174	TTCTGGTATATTGGAAGAG	6933 – 6951
SEQ ID NO:175	ATTTGTACCTACTCCAGATAATTCAG	6963 – 6988
SEQ ID NO:176	TTATAGGTACATTAATTCAAAG	6999 – 7020
SEQ ID NO:177	TGCAGTTGTTGAAAAAGAA	7038 – 7056
SEQ ID NO:178	CTTTGCAAAATATACA	7068 – 7083

Table 10. Sequences and loci of oligonucleotides for identifying HPV 39

SEQ ID NO:	5' → 3'	Locus in HPV 39
SEQ ID NO:179	CTCTATAGAGTCTTC	6677 – 6691
SEQ ID NO:180	TAGAGTCTTCCATACCTTCT	6682 – 6701
SEQ ID NO:181	ATAGAGTCTTCCATACCTTC	6681 – 6700
SEQ ID NO:182	GTCTTCCATACCTTCTACATATG	6686 – 6708
SEQ ID NO:183	CTACATATGATCCTTCTAAG	6700 – 6719
SEQ ID NO:184	TACTGTACATTAACAACCTGATG	6779 – 6801
SEQ ID NO:185	TTCCTCTATATTGGACAA	6827 – 6844
SEQ ID NO:186	TGTAGCTCCTCCACCATCTGCCAGTT	6857 – 6882
SEQ ID NO:187	TTACAGATACCTACAGTCTGCA	6893 – 6914
SEQ ID NO:188	GGATGCTCCAGCACCTGAA	6932 – 6950
SEQ ID NO:189	ATATGACGGTCTAAAG	6962 – 6977
SEQ ID NO:190	GGCCCAAAGGGATGCACAAGCAG	1149 – 1171
SEQ ID NO:191	CAGACAGCAGTGGCGACACTAGACCGTATG	1196 – 1225
SEQ ID NO:192	GTAGGCAGGAATACCAGGGGAACAC	1234 – 1258
SEQ ID NO:193	GCAGTACGCAGGCAACACAAACGGTG	1283 – 1308
SEQ ID NO:194	GGAGGAGGTAACCTGTAGCAACTAATA	1362 – 1387
SEQ ID NO:195	CATGGCGGCAGTGTACGGGAGGAGTG	1411 – 1436
SEQ ID NO:196	GGATAGTGCTATAGATAGTGAAAACC	1446 – 1471
SEQ ID NO:197	CTCCAACCTGCACAAATTAAATTATTG	1484 – 1509
SEQ ID NO:198	CCAATAACAAAAAGGCTGCAATGCTA	1517 – 1542

Table 11. Sequences and loci of oligonucleotides for identifying HPV 44

SEQ ID NO:	5' → 3'	Locus in HPV 40
SEQ ID NO:199	TGCCACTACACAGTC	6719 – 6733
SEQ ID NO:200	CTACACAGTCCCCTCCGTCT	6724 – 6743
SEQ ID NO:201	TGCCACTACACAGTCCCCTC	6719 – 6738
SEQ ID NO:202	CAGTCCCCTCCGTCTACATATA	6729 – 6750
SEQ ID NO:203	CTACATATACTAGTGAACAA	6742 – 6761

SEQ ID NO:204	TAGTATTACCTTAACGGCGGAGG	6821 – 6843
SEQ ID NO:205	TGCTGGTATTTTAGAACAG	6869 – 6887
SEQ ID NO:206	GTTGTCGCCGCCCCCAAATGGTACCT	6899 – 6924
SEQ ID NO:207	ATACAGATATGTGCAGTCCCAG	6935 – 6956
SEQ ID NO:208	GCCACCCCCTGAAAAGGCA	6974 – 6992
SEQ ID NO:209	CTATGCAAAATTAAGT	7004 – 7019
SEQ ID NO:210	GGCGGATGCTCATTATGCGGCTG	1038 – 1060
SEQ ID NO:211	GGTAGTCCATATGTTAGTCCTTTAAGTAAT	1087 – 1116
SEQ ID NO:212	CACGGCTGGACGCTATAACATTAAGT	1148 – 1173
SEQ ID NO:213	GACGGCTGTTTGACAGACCAGAATTA	1196 – 1221
SEQ ID NO:214	GCTGAAACGCAGGTAGAGAGAAATGG	1255 – 1280
SEQ ID NO:215	GGGAGGTGGACAAGGAAGGGACACAG	1299 – 1324
SEQ ID NO:216	GGAAGTGCAGACACATAGCAACACAC	1347 – 1372
SEQ ID NO:217	GGTACTAGAACTATTGAAATGTAAGA	1395 – 1420
SEQ ID NO:218	GCTTGGTAAGTTTAAGGATTGCTATG	1437 – 1462

Table 12. Sequences and loci of oligonucleotides for identifying HPV 45

SEQ ID NO:	5' → 3'	Locus in HPV 45
SEQ ID NO:219	TGCCTCTACACAAAATCCTG	6651 – 6670
SEQ ID NO:220	CTCTACACAAAATCC	6654 – 6668
SEQ ID NO:221	ACAAAATCCTGTGCCAAGTA	6660 – 6679
SEQ ID NO:222	CAAAAATCCTGTGCCAAGTAC	6661 – 6680
SEQ ID NO:223	AATCCTGTGCCAAGTACATATG	6664 – 6685
SEQ ID NO:224	GTACATATGACCCTACTAAG	6677 – 6696
SEQ ID NO:225	CACTATTACTTTAACTGCAGAGG	6756 – 6778
SEQ ID NO:226	TAGTAGTATATTAGAAAAT	6804 – 6822
SEQ ID NO:227	TGTCCCTCCACCACCTACTACAAGTT	6834 – 6859
SEQ ID NO:228	ATATCGTTTTTGTGCAATCAGTT	6870 – 6891
SEQ ID NO:229	GGATACTACACCTCCAGAA	6909 – 6927
SEQ ID NO:230	AGTTCAGAATGATGCACAGGTGT	1135 – 1157
SEQ ID NO:231	GCAGCTAAGTGTGGATACGGATCTAAGTCC	1216 – 1245
SEQ ID NO:232	CAAGAAATTTTCAATTAATAGTGGGCA	1253 – 1278
SEQ ID NO:233	ACGGTTGTTTACAATATCAGATAGTG	1294 – 1319
SEQ ID NO:234	CATAGTACACAAAGTAGTGGTGGGGA	1397 – 1422
SEQ ID NO:235	GACAATGCAGAAAATGTAGATCCGCA	1430 – 1455
SEQ ID NO:236	GGAGCTATTACAAGCAAGTAACAAAA	1477 – 1502
SEQ ID NO:237	GCAATGCTGGCAGTATTTAAAGACA	1508 – 1532
SEQ ID NO:238	ATATGGGCTGTCATTACGGATTTGG	1534 – 1559

Table 13. Sequences and loci of oligonucleotides for identifying HPV 51

SEQ ID NO:	5' → 3'	Locus in HPV
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		51
SEQ ID NO:239	CACTGCCACTGCTGCGGTTT	6555 – 6574
SEQ ID NO:240	TGCCACTGCTGCGGT	6558 – 6572
SEQ ID NO:241	CACTGCTGCGGTTTCCCCAA	6561 – 6580
SEQ ID NO:242	CCACTGCTGCGGTTTCCCCA	6560 – 6579
SEQ ID NO:243	CTGCGGTTTCCCCAACATTTAC	6566 – 6587
SEQ ID NO:244	CAACATTTACTCCAAGTAAC	6578 – 6597
SEQ ID NO:245	TAAAATTACTTTAACTACAGAGG	6657 – 6679
SEQ ID NO:246	TCCTACCATTCTTGAACAG	6705 – 6723
SEQ ID NO:247	ATTAACATTACCTCCGTCTGCTAGTT	6735 – 6760
SEQ ID NO:248	ATATAGGTTTGTAGAAATGCA	6771 – 6792
SEQ ID NO:249	GGACACCCCTCCACAGGCT	6810 – 6828
SEQ ID NO:250	TTTGGCCAAATATAAA	6840 – 6855
SEQ ID NO:251	ATTACAGGCAAACAAAGAGGCTG	1092 – 1114
SEQ ID NO:252	GCGAAGCAGCCCATTAGGAGACATTACAAA	1149 – 1178
SEQ ID NO:253	CCATAGTCAGGCAAACGAGTCACAAG	1197 – 1222
SEQ ID NO:254	AGATTACTGGACAGTTATCCGGACA	1231 – 1255
SEQ ID NO:255	CAGGTAGATGGGCAACATGGCGGTTC	1300 – 1325
SEQ ID NO:256	AGCTGTGCAAATGTAGAACTAAACAG	1384 – 1409
SEQ ID NO:257	GGTATTAGTTATAATGAGTTGGTACG	1477 – 1502

Table 14. Sequences and loci of oligonucleotides for identifying HPV 52

SEQ ID NO:	5' → 3'	Locus in HPV 52
SEQ ID NO:258	TGAGGTAAAAAAGGA	6695 – 6709
SEQ ID NO:259	TGAGGTAAAAAAGGAAAGCA	6695 – 6714
SEQ ID NO:260	GAGGTAAAAAAGGAAAGCAC	6696 – 6715
SEQ ID NO:261	TTAAAAAGGAAAGCACATAT	6700 – 6719
SEQ ID NO:262	AAAGGAAAGCACATATAAAAAT	6704 – 6725
SEQ ID NO:263	GCACATATAAAAATGAAAAT	6712 – 6731
SEQ ID NO:264	CAAAATTACATTAACAGCTGATG	6791 – 6813
SEQ ID NO:265	TGCCACTATTTTAGAGGAC	6839 – 6857
SEQ ID NO:266	CCTTACCCACCACCGTCTGCATCTT	6869 – 6894
SEQ ID NO:267	ATACAGATTTGTCACTTCTACT	6905 – 6926
SEQ ID NO:268	AAACACACCACCTAAAGGA	6944 – 6962
SEQ ID NO:269	TTTAAAGGACTATATG	6974 – 6989
SEQ ID NO:270	AGGGGAGGATGATTTACATGCTG	1085 – 1107
SEQ ID NO:271	GCAGTCCGGAAAGTGCTGGGCAAGATGGTG	1135 – 1164
SEQ ID NO:272	GGTAGTCCGCGTGCAAAACACATTTG	1176 – 1201
SEQ ID NO:273	CCAAAACGCAAACCATGTACGCTAGA	1224 – 1249
SEQ ID NO:274	CAAAATGGCGACTGGCAAAGTA	1311 – 1332
SEQ ID NO:275	GCTAGTAATTCAGATGTAAGTTGTAC	1359 – 1384
SEQ ID NO:276	GAGGAAAATAGTAATAGAACGCTAAA	1401 – 1426

SEQ ID NO:277	GCGAAAATAGCATAAAAACAACCTGTA	1447 – 1472
SEQ ID NO:278	AGAAACATATGGTGTAGCTTTATGG	1487 – 1512

Table 15. Sequences and loci of oligonucleotides for identifying HPV 53

SEQ ID NO:	5'→3'	Locus in HPV 53
SEQ ID NO:279	TCCGCAACCACACAGTCTAT	6681 – 6700
SEQ ID NO:280	CCGCAACCACACAGT	6682 – 6696
SEQ ID NO:281	CCGCAACCACACAGTCTATG	6682 – 6701
SEQ ID NO:282	CACAGTCTATGTCTACATATAA	6691 – 6712
SEQ ID NO:283	CTACATATAATTCAAAGCAA	6703 – 6722
SEQ ID NO:284	TAAAATATCCCTGTCTGCTGAGG	6782 – 6804
SEQ ID NO:285	TTCTACCTTACTGGAAGAC	6830 – 6848
SEQ ID NO:286	TTTGTCGCCTCCTGTTGCCACTAGCT	6860 – 6885
SEQ ID NO:287	ATACAGATATGTGAAAAGTGCA	6896 – 6917
SEQ ID NO:288	GGATCAGCCCCCTCCTGAA	6935 – 6953

Table 16. Sequences and loci of oligonucleotides for identifying HPV 54

SEQ ID NO:	5'→3'	Locus in HPV 54
SEQ ID NO:289	TACAGCATCCACGCA	6633 – 6647
SEQ ID NO:290	CAGCATCCACGCAGGATAGC	6635 – 6654
SEQ ID NO:291	ACGCAGGATAGCTTTAATAA	6643 – 6662
SEQ ID NO:292	CACGCAGGATAGCTTTAATA	6642 – 6661
SEQ ID NO:293	ATAGCTTTAATAATTCTGAC	6650 – 6669
SEQ ID NO:294	TACCATAACCCTTACAGCAGATG	6729 – 6751
SEQ ID NO:295	TCCCACTATTCTAGAGGAC	6777 – 6795
SEQ ID NO:296	TATAACCCCCCAGCTACAAGTAGTT	6807 – 6832
SEQ ID NO:297	ATATAGGTTTGTACAGTCACAG	6843 – 6864
SEQ ID NO:298	GAATAATGCCCTGCAAAGGAA	6882 – 6903
SEQ ID NO:299	GCTGCAGGCAGATGTAGAGGCAG	1043 – 1065
SEQ ID NO:300	CGTATGTAAGTCCTGTTGCAAACAGCGAAC	1099 – 1128
SEQ ID NO:301	CTGTGTAGAAAAGGACCTAA	1130 – 1149
SEQ ID NO:302	TATATCCCTAGGACGGCGGTCAGCCA	1166 – 1191
SEQ ID NO:303	GGTAAATACCGAGGGGACAGATGAAA	1265 – 1290
SEQ ID NO:304	GAAACAACCTACAGATAGCCTAGGAAG	1323 – 1348
SEQ ID NO:305	CGTGTAGCATTGTTTGGTATGTTTAA	1386 – 1411
SEQ ID NO:306	TATGGATTAAGTTTTATGGACC	1419 – 1440

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Table 17. Sequences and loci of oligonucleotides for identifying HPV 56

SEQ ID NO:	5'→3'	Locus in HPV
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		56
SEQ ID NO:307	CTGCTACAGAACAGT	6630 – 6644
SEQ ID NO:308	GCTACAGAACAGTTAAGTAA	6632 – 6651
SEQ ID NO:309	CAGAACAGTTAAGTAAATAT	6636 – 6655
SEQ ID NO:310	GAACAGTTAAGTAAATATGATGC	6638 – 6660
SEQ ID NO:311	GTAAATATGATGCACGAAAA	6648 – 6667
SEQ ID NO:312	CAAAATTACTTTGTCTGCAGAGG	6727 – 6749
SEQ ID NO:313	TGCTAACCTACTGGAGGAC	6775 – 6793
SEQ ID NO:314	GTTATCCCCGCCAGTGGCCACCAGCC	6805 – 5830
SEQ ID NO:315	ATATAGATATGTTAGAAGCACA	6841 – 6862
SEQ ID NO:316	GGAACAGCCACCAACAGAA	6880 – 6898

Table 18. Sequences and loci of oligonucleotides for identifying HPV 58

SEQ ID NO:	5' → 3'	Locus in HPV 58
SEQ ID NO:317	ATGCACTGAAGTAACTAAGG	6674 – 6693
SEQ ID NO:318	CACTGAAGTAACTAAGGAAG	6677 – 6696
SEQ ID NO:319	TGAAGTAACTAAGGA	6680 – 6694
SEQ ID NO:320	GAAGTAACTAAGGAAGGTAC	6681 – 6700
SEQ ID NO:321	CTAAGGAAGGTACATATAAAAA	6688 – 6709
SEQ ID NO:322	ATAAAAATGATAATTTTAAG	6703 – 6722
SEQ ID NO:323	CAAAATTACACTAACTGCAGAGA	6776 – 6798
SEQ ID NO:324	TTCCAATATTTTGGAGGAC	6824 – 6842
SEQ ID NO:325	TTTAACACCTCCTCCGTCTGCCAGTT	6854 – 6879
SEQ ID NO:326	ATATAGATTTGTTACCTCCCAG	6890 – 6911
SEQ ID NO:327	AACAGCACCCCCTAAAGAA	6929 – 6947
SEQ ID NO:328	AGGGGTGGACGATATAAATGCTG	1104 – 1126
SEQ ID NO:329	GCATGCTCAGAAAGTGCTGTAGA	1153 – 1175
SEQ ID NO:330	GCAAATGTGTGTGTATCGTGGAATATAAA	1195 – 1224
SEQ ID NO:331	AAATTATTGAGCTAGAAGACAG	1253 – 1274
SEQ ID NO:332	GCACACCAGGTAGAAAGCCAA	1312 – 1332
SEQ ID NO:333	GGCTAGTTCAGATGTAAGCAGTGAAA	1377 – 1402
SEQ ID NO:334	GTAATATTCTACATAACAGTAA	1445 – 1466
SEQ ID NO:335	GCAACGCTATTATATAAATTC	1474 – 1494
SEQ ID NO:336	GCTTATGGAGTAAGTTTTATGGAA	1501 – 1524

Table 19. Sequences and loci of oligonucleotides for identifying HPV 59

SEQ ID NO:	5' → 3'	Locus in HPV 59
SEQ ID NO:337	TTCTACTACTTCTTC	6643 – 6657
SEQ ID NO:338	ACTACTTCTTCTATTCCCTAA	6647 – 6666
SEQ ID NO:339	ACTTCTTCTATTCCCTAATGT	6650 – 6669

SEQ ID NO:340	TCTTCTATTCCTAATGTATACAC	6653 – 6675
SEQ ID NO:341	ATGTATACACACCTACCAGT	6666 – 6685
SEQ ID NO:342	TAAAATAACATTAACACAGAGG	6745 – 6767
SEQ ID NO:343	TACCACTATTTTGGAGGAT	6793 – 6811
SEQ ID NO:344	TGTTACACCACCTCCTACTGCTAGTT	6823 – 6848
SEQ ID NO:345	ATACCGTTTTTGTTCATCTGCT	6859 – 6880
SEQ ID NO:346	GGACACCGCACCGCCAGTT	6898 – 6916
SEQ ID NO:347	TTATGACAAACTAAAG	6928 – 6943
SEQ ID NO:348	AGCCCAAAGGGATGCACGGGAAA	1093 – 1115
SEQ ID NO:349	GCAGTATAGAAAACAGTAGTGAGAAAGCGG	1143 – 1172
SEQ ID NO:350	CCATTACAAGAAATATCAGTAAATG	1196 – 1220
SEQ ID NO:351	GGTTAATAACAGTGCCAGACAGCG	1245 – 1268
SEQ ID NO:352	GGTAACCGTGGAGAATACTGGAAATG	1306 – 1331
SEQ ID NO:353	CTGTAGCGACAGCAGTAACATGGATG	1372 – 1397
SEQ ID NO:354	CCCACTAATCAATTGTTACAGTTA	1421 – 1444
SEQ ID NO:355	GGGTTATCATTTCAGATTGG	1499 – 1520

Table 20. Sequences and loci of oligonucleotides for identifying HPV 61

SEQ ID NO:	5' → 3'	Locus in HPV 61
SEQ ID NO:356	CTGCTACATCCCCC	6803 – 6817
SEQ ID NO:357	ACATCCCCCCTGTATCTGA	6808 – 6827
SEQ ID NO:358	CATCCCCCCTGTATCTGAA	6809 – 6828
SEQ ID NO:359	CCCCTGTATCTGAATATAAAGC	6815 – 6836
SEQ ID NO:360	CTGAATATAAAGCCACAAGC	6824 – 6843
SEQ ID NO:361	TAAAATACATTTAACCCCTGAAA	6903 – 6925
SEQ ID NO:362	TAAGGCCTTGTTGGATGAC	6951 – 6969
SEQ ID NO:363	TGTGGTACCACCACCCTCTACCAGTT	6981 – 7006
SEQ ID NO:364	ATATAGGTTTTTGCAGTCCAGA	7017 – 7038
SEQ ID NO:365	GGGTGCTGCTGCCCCGCCGCC	7056 – 7077
SEQ ID NO:366	CTATGCCAAGTTATCC	7089 – 7104
SEQ ID NO:367	TGCACAGGATGACGCTGCAACGG	1038 – 1060
SEQ ID NO:368	CCTTGGTGGACAGTGAATTAAGTCCC	1115 – 1140
SEQ ID NO:369	GGACAGGACAGGGCTAGGAGAAGGCTGTTT	1168 – 1197
SEQ ID NO:370	TGTTTGAGCAAGATAGTGGC	1193 – 1212
SEQ ID NO:371	GGATGCGCAACATGAGGGGGGGGGG	1263 – 1288
SEQ ID NO:372	GGCCGAGGCCACAGGTAACCAGGAAA	1335 – 1360
SEQ ID NO:373	GGCAGACATATTAGAGGTGTTTAAGG	1380 – 1405
SEQ ID NO:374	CTGTACAAATTCAAGGACCTATTTGG	1429 – 1454
SEQ ID NO:375	CTAGCATTGTTGGGAGCTGGTA	1456 – 1476

Table 21. Sequences and loci of oligonucleotides for identifying HPV 62

SEQ ID NO:	5' → 3'	Locus in HPV 62
SEQ ID NO:376	CCGCCTCCACTGCTG	92 – 106
SEQ ID NO:377	GCCTCCACTGCTGCAGCAGA	94 – 113
SEQ ID NO:378	CTGCTGCAGCAGAATACACG	101 – 120
SEQ ID NO:379	GCAGAATACACGGCTACCAA	109 – 128
SEQ ID NO:380	CAGAATACACGGCTACCAAC	110 – 129
SEQ ID NO:381	CAAAATACAGTTAACCCCCGAAA	189 – 211
SEQ ID NO:382	CAAGGACCTTTTGGATGAC	237 – 255
SEQ ID NO:383	GGTTTACCTCCCCCTTCCACTAGTT	267 – 292
SEQ ID NO:384	ATATCACTATTTCGAGTCTCGG	303 – 324
SEQ ID NO:385	GGGGCTGCCTACCCGTCCC	342 – 360
SEQ ID NO:386	GTATGCGCAAATGACA	372 – 387

Table 22. Sequences and loci of oligonucleotides for identifying HPV 66

SEQ ID NO:	5' → 3'	Locus in HPV 66
SEQ ID NO:387	CAGCTAAAAGCACAT	6680 – 6694
SEQ ID NO:388	CAGCTAAAAGCACATTA ACT	6680 – 6699
SEQ ID NO:389	CTAAAAGCACATTA ACTAAA	6683 – 6702
SEQ ID NO:390	TTAACTAAATATGATGCCCCG	6694 – 6713
SEQ ID NO:391	CTAAATATGATGCCCCGTGAA	6698 – 6717
SEQ ID NO:392	TAAAATAACCTTAACTGCAGAAG	6777 – 6799
SEQ ID NO:393	TAATACTTTATTAGACGAT	6825 – 6843
SEQ ID NO:394	CTTATCCCCACCAGTTGCAACTAGCT	6855 – 6880
SEQ ID NO:395	ATATAGGTATATTAAAAGCACA	6891 – 6912
SEQ ID NO:396	GGAACAGCCCCCTGCAGAA	6930 – 6948
SEQ ID NO:397	CCTGGCTAAATATAAG	6960 – 6975
SEQ ID NO:398	AGCACATGCAGATGCACAGACG	1116 – 1137
SEQ ID NO:399	GGTAGTCCCTTAAAGTGATATTAGTAA	1165 – 1190
SEQ ID NO:400	GCAAACCTGTGTACCGAGAGGAAGTAA	1194 – 1219
SEQ ID NO:401	AAGGCTAATATTATCAGAAGACAGCGGGTA	1224 – 1253
SEQ ID NO:402	GAAACATCACAAACAGGTAGAATACG	1276 – 1300
SEQ ID NO:403	GAGCTCACAAAATGGAGGCTCGCAAA	1320 – 1345
SEQ ID NO:404	ATCAAATATGGATATAGATACAAATA	1371 – 1396
SEQ ID NO:405	CCAATTGCAGGA ACTATT TAAAAGTA	1413 – 1438
SEQ ID NO:406	CAAGGAAGATTACATTTTAAATTTAA	1447 – 1472
SEQ ID NO:407	AGAAGTGTATGGAGTGCCAT	1473 – 1492

Table 23. Sequences and loci of oligonucleotides for identifying HPV 67

SEQ ID NO:	5' → 3'	Locus in HPV 67
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SEQ ID NO:408	CTGAGGAAAAATCAG	6655 – 6669
SEQ ID NO:409	GAGGAAAAATCAGAGGCTAC	6657 – 6676
SEQ ID NO:410	ATCAGAGGCTACATACAAAAATG	6665 – 6687
SEQ ID NO:411	AGGAAAAATCAGAGGCTACA	6658 – 6677
SEQ ID NO:412	CTACATACAAAAATGAAAAC	6673 – 6692
SEQ ID NO:413	CAAAATATCCCTTACTGCAAATG	6752 – 6774
SEQ ID NO:414	TCCAGATATATTAGAGGAC	6800 – 6818
SEQ ID NO:415	CCTTACACCACCTCCTTCAGGTAATT	6830 – 6855
SEQ ID NO:416	ATATAGATTTGTTACCTCGCAG	6866 – 6887
SEQ ID NO:417	AACATCCCCTCCAACAGCA	6905 – 6923
SEQ ID NO:418	TCTTAAAAAGTACAGT	6935 – 6950
SEQ ID NO:419	AGAGGAGGATGACCTAAACGCTG	1096 – 1118
SEQ ID NO:420	CAGGCATGTGGTGGTAATAGTAATGG	1151 – 1176
SEQ ID NO:421	GCCGCAAAACGCAGAGCATACGACATAGAA	1199 – 1228
SEQ ID NO:422	GGCAAAATGGCGATATGCAGTGCAGT	1287 – 1312
SEQ ID NO:423	GCAAGTAGTACGGGAAACAGTGTAGA	1331 – 1356
SEQ ID NO:424	GTCAGGAACAAAGCATGCCATTGCAA	1380 – 1405
SEQ ID NO:425	GCATGTAAATAATATAAAGGCAACG	1423 – 1447
SEQ ID NO:426	GGAAGCATATGGGGTAACGTTTACAC	1465 – 1490

Table 24. Sequences and loci of oligonucleotides for identifying HPV 68

SEQ ID NO:	5' → 3'	Locus in HPV 68
SEQ ID NO:427	CTACTACTGAATCAG	2653 – 2667
SEQ ID NO:428	TGAATCAGCTGTACCAAATA	2660 – 2679
SEQ ID NO:429	GAATCAGCTGTACCAAATAT	2661 – 2680
SEQ ID NO:430	CAGCTGTACCAAATATTTATGA	2665 – 2686
SEQ ID NO:431	ATATTTATGATCCTAATAAA	2677 – 2696
SEQ ID NO:432	TCCTGCTATTTTGGATGAT	2804 – 2822
SEQ ID NO:433	TACTATAACATTGTCCACTGATG	2756 – 2778
SEQ ID NO:434	TGTTGCCCCTCCACCATCTGCTAGTC	2834 – 2859
SEQ ID NO:435	ATACCGCTATCTGCAATCAGCA	2870 – 2891
SEQ ID NO:436	AGACGCCCTGCACCTACT	2909 – 2927
SEQ ID NO:437	ATATGATGGCTTAAAC	2939 – 2954
SEQ ID NO:438	GGCCCAAAGGGATGCACAAACAG	4990 – 5012
SEQ ID NO:439	GCCCTTTAGCAAAGTCGCCATTACAG	5055 – 5080
SEQ ID NO:440	GGTAACTGTAGCAACTAATA	5115 – 5134
SEQ ID NO:441	GGAAAATGGCGACAGCATACGGGAGGACTG	5163 – 5192
SEQ ID NO:442	GACAGTGCTATAGATAGTGAAAACCA	5203 – 5228
SEQ ID NO:443	CCTACTACGCAACTAAAAGTATTA	5242 – 5265
SEQ ID NO:444	AAGCTGCAATGTTAACAGAATTTAAA	5285 – 5310

Table 25. Sequences and loci of oligonucleotides for identifying HPV 69

SEQ ID NO:	5'→ 3'	Locus in HPV 69
SEQ ID NO:445	TATTAGTACTGTATCTGCAC	6572 – 6591
SEQ ID NO:446	CTGTATCTGCACAAT	6580 – 6594
SEQ ID NO:447	CTGTATCTGCACAATCTGCA	6580 – 6599
SEQ ID NO:448	TGCACAATCTGCATCTGCCA	6587 – 6606
SEQ ID NO:449	CAATCTGCATCTGCCACTTTTA	6591 – 6612
SEQ ID NO:450	CCACTTTTAAACCATCAGAT	6604 – 6623
SEQ ID NO:451	TAAAATTACTCTTACCACTGATG	6683 – 6705
SEQ ID NO:452	TTCTACTATTTTGGAAAAT	6731 – 6749
SEQ ID NO:453	CCTTACCTTGCCTCCTACTGCTAGTT	6761 – 6786
SEQ ID NO:454	ATATAGGTTTATTAAAAATTCA	6797 – 6818
SEQ ID NO:455	CGATGCCCCTGCACAGCCC	6836 – 6854
SEQ ID NO:456	AACACAAGCAAATAAGAAGGCAG	1101 – 1123
SEQ ID NO:457	GAACAGCCCGTTGCAAGACATAACAA	1158 – 1183
SEQ ID NO:458	CAGACGAAGTAAACAATTTACAGGC	1208 – 1232
SEQ ID NO:459	GGAGAGCAGTGGACAGTGTTCCGGACAGCG	1238 – 1267
SEQ ID NO:460	GGTAGATAAACACAATGAACAAAATG	1308 – 1333
SEQ ID NO:461	TCAAGTGGATCTGTATCAGACA	1360 – 1381
SEQ ID NO:462	GCACAGGCAAGTAGTGTAACCAAAA	1399 – 1423
SEQ ID NO:463	GTAATGTAAAAGCAGCATTATTAA	1445 – 1468
SEQ ID NO:464	CAGTATATGGTGTAAGTTATA	1481 – 1501

Table 26. Sequences and loci of oligonucleotides for identifying HPV 6

SEQ ID NO:	5'→ 3'	Locus in HPV 6
SEQ ID NO:465	CATCCGTAACCTACATCTTCC	6814 – 6833
SEQ ID NO:466	ATCCGTAACCTACATCTTCCA	6815 – 6834
SEQ ID NO:467	CTACATCTTCCACATACACCAA	6823 – 6844
SEQ ID NO:468	CATCTTCCACATACACCAAT	6826 – 6845
SEQ ID NO:469	ATCTTCCACATACACCAATT	6827 – 6846
SEQ ID NO:470	CCACATACACCAATTCTGAT	6832 – 6851
SEQ ID NO:471	TAGCATTACATTGTCTGCTGAAG	6911 – 6933
SEQ ID NO:472	TCCCTCTGTTTGGGAAGAC	6959 – 6977
SEQ ID NO:473	GTTATCGCCTCCCCCAAATGGTACAT	6989 – 7014
SEQ ID NO:474	CTATAGGTATGTGCAGTCACAG	7025 – 7046
SEQ ID NO:475	GCCCACTCCTGAAAAGGAA	7064 – 7082
SEQ ID NO:476	CTATAAGAACCTTAGT	7094 – 7109
SEQ ID NO:477	GGCGGACACCCATTATGCGACTG	1045 – 1067
SEQ ID NO:478	GTTAGTCCTATAAACACTATAGCCGA	1106 – 1131
SEQ ID NO:479	CCACGATTGGACGCCATTAACTTACAAGA	1154 – 1183
SEQ ID NO:480	GGCTGTTTCAAACCAGGGAACCTAACG	1206 – 1231
SEQ ID NO:481	GGTAGAGAAACATGGCGTACCGGAAA	1279 – 1304

SEQ ID NO:482	GGACACAGGAAGGGACATAGAGGGGG	1327 – 1352
SEQ ID NO:483	CACAAACAGTGTACGGGAGCATGCAG	1378 – 1403
SEQ ID NO:484	GCTAAATGTAAAGATTTACGGGCAG	1426 – 1451
SEQ ID NO:485	GCTTTGGGCTGTCTTTTATAGATTTA	1476 – 1501

Table 27. Sequences and loci of oligonucleotides for identifying HPV 70

SEQ ID NO:	5' → 3'	Locus in HPV 70
SEQ ID NO:486	TGTCTGCCTGCACCGAAACG	6614 – 6633
SEQ ID NO:487	CTGCACCGAAACGGC	6621 – 6635
SEQ ID NO:488	GAAACGGCCATACCTGCTGT	6628 – 6647
SEQ ID NO:489	CGAAACGGCCATACCTGCTG	6627 – 6646
SEQ ID NO:490	CGGCCATACCTGCTGTATATAG	6632 – 6653
SEQ ID NO:491	CTGTATATAGCCCTACAAAG	6644 – 6663
SEQ ID NO:492	TACTATCACATTAAGTCTGACG	6723 – 6745
SEQ ID NO:493	TCCTGCAATTTTGGACAAT	6771 – 6789
SEQ ID NO:494	AGTTACCCCTCCACCATCTGCAAGCT	6801 – 6826
SEQ ID NO:495	GTATAGGTATTACAATCAGCA	6837 – 6858
SEQ ID NO:496	GGATGCTCCTACACCTGAA	6876 – 6894
SEQ ID NO:497	CTATGACGATTAAAA	6906 – 6921
SEQ ID NO:498	GGCCCAAAGGGATGCACAATCAG	1149 – 1171
SEQ ID NO:499	GCAATCTAAATAAAAGTCCTTGT	1202 – 1224
SEQ ID NO:500	GTACATAGGGAACAAAGGGTAACAC	1240 – 1264
SEQ ID NO:501	GGTAAACATATGCAATAAACAGG	1278 – 1300
SEQ ID NO:502	ACAAACGTGTATTTCAGTACCAGACAGCGGC	1306 – 1335
SEQ ID NO:503	GTAGTAAATAATACAAATGGGGAAGA	1378 – 1403
SEQ ID NO:504	GGAGTGCAGTAGTGTAGACAGTGCTA	1446 – 1471
SEQ ID NO:505	TCCACAGTCACCTACTGCACAGCTAA	1491 – 1516
SEQ ID NO:506	GCTAATAACCAAAAAGCCATACTAC	1531 – 1555
SEQ ID NO:507	CACACATATGGATTAGCATTTAACGA	1570 – 1595

Table 28. Sequences and loci of oligonucleotides for identifying HPV 72

SEQ ID NO:	5' → 3'	Locus in HPV 72
SEQ ID NO:508	ATCTGTTGGTTTAATGAGCT	6759 – 6778
SEQ ID NO:509	TTTGTGACAGTTGTAGATAC	6780 – 6799
SEQ ID NO:510	CTGCCACAGCGTCCT	6829 – 6843
SEQ ID NO:511	ACAGCGTCCTCTGTATCAGA	6834 – 6853
SEQ ID NO:512	CCACAGCGTCCTCTGTATCA	6832 – 6851
SEQ ID NO:513	AGCGTCCTCTGTATCAGAATAT	6836 – 6857
SEQ ID NO:514	CAGAATATACAGCTTCTAAT	6850 – 6869
SEQ ID NO:515	TAAAATTCACCTAACTCCTGAAA	6929 – 6951

SEQ ID NO:516	TAAGGCCTTATTGGATGAC	6977 – 6995
SEQ ID NO:517	TGTGGTGCCTCCTCCTTCTACCAGTT	7007 – 7032
SEQ ID NO:518	CTATAGGTTTTTGCAGTCTCGT	7043 – 7064
SEQ ID NO:519	GGGGGCTGCCACCCCTCCTCCT	7082 – 7103
SEQ ID NO:520	ATATGCTAACTTATCC	7115 – 7130

Table 29. Sequences and loci of oligonucleotides for identifying HPV 74

SEQ ID NO:	5'→3'	Locus in HPV 74
SEQ ID NO:521	CCTACCTCACAATCG	1686 – 1700
SEQ ID NO:522	CTCACAATCGCCTTCTGCTA	1691 – 1710
SEQ ID NO:523	ACCTCACAATCGCCTTCTGC	1689 – 1708
SEQ ID NO:524	CAATCGCCTTCTGCTACATATA	1695 – 1716
SEQ ID NO:525	ACAATCGCCTTCTGCTACATAT	1694 – 1715
SEQ ID NO:526	CTACATATAAATAGTTCAGAC	1708 – 1727
SEQ ID NO:527	TAGTATTAAGTTAACTGCTGAGG	1787 – 1809
SEQ ID NO:528	TCCTACAGTTTTAGAAGAG	1835 – 1853
SEQ ID NO:529	GCTAACGCCTCCCCCAATGGTACTT	1865 – 1890
SEQ ID NO:530	CTACAGATATGTGCAGTCCCAG	1901 – 1922
SEQ ID NO:531	ACCTACGCCTGATAAAGCA	1940 – 1958
SEQ ID NO:532	CTATGCAAATTTAAGT	1970 – 1985

Table 30. Sequences and loci of oligonucleotides for identifying HPV 82

SEQ ID NO:	5'→3'	Locus in HPV 82
SEQ ID NO:533	TGCTGTTACTCCATC	6608 – 6622
SEQ ID NO:534	TGCTGTTACTCCATCTGTTG	6608 – 6627
SEQ ID NO:535	ACTCCATCTGTTGCACAAAC	6615 – 6634
SEQ ID NO:536	AAACATTTACTCCAGCAAAC	6631 – 6650
SEQ ID NO:537	TAAAATCACTTTAACTACTGAAA	6710 – 6732
SEQ ID NO:538	TTCTACAATTTTAGAACAG	6758 – 6776
SEQ ID NO:539	ATTAAACATTGCCCCCTCCGCTAGTT	6788 – 6813
SEQ ID NO:540	CTATCGATTTGTAAAAAATGCA	6824 – 6845
SEQ ID NO:541	GGACAGTCCTCCACAGGCT	6863 – 6881
SEQ ID NO:542	AACACAGGCACACAAAGAGGCTG	1094 – 1116
SEQ ID NO:543	GCAGCCCATTAAGACATTACAAA	1156 – 1180
SEQ ID NO:544	GTCAGCAACAACAAAACAGGCAAACCTTC	1201 – 1230
SEQ ID NO:545	GGAGATTACTGGACAGTTATCCGGACA	1243 – 1269
SEQ ID NO:546	CCTTACAGGTAGATGGGCAAAATGAC	1309 – 1334
SEQ ID NO:547	GAGCAGCGACAGAAGTACAGAGATAG	1367 – 1392
SEQ ID NO:548	GCTACCAATGTAGGACTAAACAGTA	1413 – 1437
SEQ ID NO:549	GTAGCAATGCAAAAGCAATGTTTATG	1456 – 1481

SEQ ID NO:550	GGTGTAGTTATAATGAGTTGGTAAG	1503 – 1528
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Table 31. Sequences and loci of oligonucleotides for identifying

HPV CP8061

SEQ ID NO:	5'→ 3'	Locus in HPV CP8061
SEQ ID NO:551	TCTGTGCTACCAAACTGTT	86 – 105
SEQ ID NO:552	CTACCAAACTGTTG	92 – 106
SEQ ID NO:553	ACCAAACTGTTGAGTCTAC	94 – 113
SEQ ID NO:554	AACTGTTGAGTCTACATATAAA	99 – 120
SEQ ID NO:555	GTTGAGTCTACATATAAAGC	103 – 122
SEQ ID NO:556	CTACATATAAAGCCTCTAGT	110 – 129
SEQ ID NO:557	TGTTATTAATTTAACAGCTGAAA	189 – 211
SEQ ID NO:558	TGCTACATTACTGGAGGAC	237 – 255
SEQ ID NO:559	GTTCTTACCACCTCCTACTG	267 – 286
SEQ ID NO:560	CTACCGCTTTTTACAGTCTCAG	303 – 324
SEQ ID NO:561	AAACAGTCCTCCTCCTGCAGAA	342 – 363
SEQ ID NO:562	CTATGCAGATCTTACA	375 – 390

5 Table 32. Sequences and loci of oligonucleotides for identifying

HPV CP8034

SEQ ID NO:	5'→ 3'	Locus in HPV CP8034
SEQ ID NO:563	CAGCTACATCTGCTG	92 – 106
SEQ ID NO:564	GCTACATCTGCTGCTGCAGA	94 – 113
SEQ ID NO:565	ACATCTGCTGCTGCAGAATACA	97 – 118
SEQ ID NO:566	TGCTGCAGAATACAAGGCCT	105 – 124
SEQ ID NO:567	GCTGCAGAATACAAGGCCTC	106 – 125
SEQ ID NO:568	CAGAATACAAGGCCTCTAAC	110 – 129
SEQ ID NO:569	TAAAATACAGTTAACACCAGAAA	189 – 211
SEQ ID NO:570	CAAGGCACTGTTGGATGAT	237 – 255
SEQ ID NO:571	TGTGTTGCCACCTCCTTCCACCAGTT	267 – 292
SEQ ID NO:572	ATATCGCTTTTTACAGTCTCGG	303 – 324
SEQ ID NO:573	GGGTGCTGCTGCCCCTGCGCCC	342 – 363
SEQ ID NO:574	TTATGCCGACATGTCA	375 – 390

Table 33. Sequences and loci of oligonucleotides for identifying

10 HPV L1AE5

SEQ ID NO:	5'→ 3'	Locus in HPV L1AE5
SEQ ID NO:575	ATCTACTGCAACTACTAATC	69 – 88

SEQ ID NO:576	CTGCAACTACTAATC	74 – 88
SEQ ID NO:577	CTGCAACTACTAATCCAGTT	74 – 93
SEQ ID NO:578	ACTACTAATCCAGTTCCATCTA	79 – 100
SEQ ID NO:579	CTAATCCAGTTCCATCTATA	83 – 102
SEQ ID NO:580	CTATATATGAACCTTCTAAA	98 – 117
SEQ ID NO:581	TAAAATTACACTTACTACTGATG	177 – 199
SEQ ID NO:582	TCCTACTATTTTAGATAGT	225 – 243
SEQ ID NO:583	TGTTAGTCCTCCCCCATCTGCTAGCT	255 – 280
SEQ ID NO:584	ATATAGGTTTTTACAGTCATCT	291 – 312
SEQ ID NO:585	GGATGTGGTTGTTCCACAA	330 – 348

Table 34. Sequences and loci of oligonucleotides for identifying

HPV MM4

SEQ ID NO:	5' → 3'	Locus in HPV MM4
SEQ ID NO:586	CTGCTGTTACTCAATCTGTT	92 – 111
SEQ ID NO:587	TGCTGTTACTCAATC	93 – 107
SEQ ID NO:588	GTTACTCAATCTGTTGCACA	97 – 116
SEQ ID NO:589	TGCACAAACATTTACTCCAG	111 – 130
SEQ ID NO:590	TTACTCAATCTGTTGCACAAAC	98 – 119
SEQ ID NO:591	AAACATTTACTCCAGCAAAC	116 – 135
SEQ ID NO:592	TAAAATCACTTTAACTACTGAAA	195 – 217
SEQ ID NO:593	TTCTACAATTTTAGAACAG	243 – 261
SEQ ID NO:594	ATTAACCTTGCCCCCTCAGCTAGTT	273 – 298
SEQ ID NO:595	CTATCGATTTGTAAAAAATGCA	309 – 330
SEQ ID NO:596	GGACAGTCCTCCACAGGCT	348 – 366

5 Table 35. Sequences and loci of oligonucleotides for identifying

HPV MM7

SEQ ID NO:	5' → 3'	Locus in HPV MM7
SEQ ID NO:597	TGCTGCTACACAGGC	93 – 107
SEQ ID NO:598	GCTGCTACACAGGCTAATGA	94 – 113
SEQ ID NO:599	TGCTACACAGGCTAATGAAT	96 – 115
SEQ ID NO:600	CTACACAGGCTAATGAATACAC	98 – 119
SEQ ID NO:601	ATGAATACACAGCCTCTAAC	110 – 129
SEQ ID NO:602	CAAAATACATCTTACCCCTGAAA	189 – 211
SEQ ID NO:603	TGAACATTTATTGGATGAG	237 – 255
SEQ ID NO:604	CGTGTTACCACCTCCTTCCACCAGCC	267 – 292
SEQ ID NO:605	CTATCGCTATCTGCAGTCCCGT	303 – 324
SEQ ID NO:606	GGGTCCTTCGCCCCCTGCCCCCT	342 – 363
SEQ ID NO:607	TTATGATGGCCTTGTA	375 – 390

Table 36. Sequences and loci of oligonucleotides for identifying

HPV MM8

SEQ ID NO:	5'→3'	Locus in HPV MM8
SEQ ID NO:608	TGCTACCAACACCGA	93 - 107
SEQ ID NO:609	CTACCAACACCGAATCAGAA	95 - 114
SEQ ID NO:610	CCAACACCGAATCAGAATATAA	98 - 119
SEQ ID NO:611	CAGAATATAAACCTACCAAT	110 - 129
SEQ ID NO:612	TAAGGTCCGTCTGACTCCAGAGG	189 - 211
SEQ ID NO:613	TGACTCCTTATTAGATGAG	237 - 255
SEQ ID NO:614	TGTTGTGCCCCCTCCCTCCACAAGTT	267 - 292
SEQ ID NO:615	CTATAGGTACTTGCAGTCTCGC	303 - 324
SEQ ID NO:616	GGGGGCCGCCGCCGCAAGCCT	342 - 363
SEQ ID NO:617	TTATGCTGGCATGTCC	375 - 390

5 Table 37. Sequences and loci of oligonucleotides for identifying

HPV 42

SEQ ID NO:	5'→3'	Locus in HPV 42
SEQ ID NO:618	TATATGTTGGGGAAATCAGCTA	6802 - 6823
SEQ ID NO:619	CACTGCAACATCTGGTGATA	6874 - 6893
SEQ ID NO:620	GCAACATCTGGTGATACATATACAGCTGCT	6878 - 6907
SEQ ID NO:621	CATTAAGTGTGAAGTTATGTCA	6978 - 7000
SEQ ID NO:622	CCTAACATATTAGAGGAGTGGAATGT	7019 - 7044
SEQ ID NO:623	CACCACCACCTTCAGGAAGT	7053 - 7072
SEQ ID NO:624	GTTATAGGTATGTACAATCAGAAG	7083 - 7106
SEQ ID NO:625	GCTAAGGTAACAACGCCAGAAAAAAGGAT	7121 - 7150
SEQ ID NO:626	CAGACTTTTGGTTTTGGGAGGTAA	7158 - 7181
SEQ ID NO:627	GAAAAGTTTTCTACTGATTTA	7190 - 7210
SEQ ID NO:628	GTCAGTGATTCACAGCACAGCATAG	1111 - 1135
SEQ ID NO:629	GTCCTAGGCTTGGCGGTTTAA	1148 - 1168
SEQ ID NO:630	CCCAAGGGGCCAAACGACGATTATTCCAGT	1184 - 1213
SEQ ID NO:631	CAGCAGACACAGGTAGAACACGGACA	1261 - 1286
SEQ ID NO:632	GCAGTGGGTAGTGAAGTTGGGG	1321 - 1342
SEQ ID NO:633	GAAGAAGGTAGTACTACAAGTACGCC	1354 - 1379
SEQ ID NO:634	GGTAGAATTACTTAAGTGTAAGAAC	1392 - 1416
SEQ ID NO:635	GTTAGGTAAAGTTTAAAGAATTG	1431 - 1452
SEQ ID NO:636	GTCATTTGGCGATTAGTAAGA	1461 - 1482

Table 38. Sequences and loci of oligonucleotides for identifying

HPV 43

SEQ ID NO:	5'→3'	Locus in HPV 43
SEQ ID NO:637	CATTTGTTTTGGGAATCAGTTG	21 - 42
SEQ ID NO:638	TGACCCTACTGTGCCCAGTA	99 - 118
SEQ ID NO:639	ACTGTGCCCAGTACATATGACAATGCAAAG	106 - 135
SEQ ID NO:640	GTTTATATTTCAATTATGCATAA	177 - 199
SEQ ID NO:641	CCAGAGGTTATGACATATATT	211 - 231
SEQ ID NO:642	CCCACATTATTAGAGGACTGGAA	244 - 266
SEQ ID NO:643	CCACCTGCCTCTGCTTCTTTG	280 - 300
SEQ ID NO:644	CGCTTTTTTGTCTAACAAGGCCATTG	313 - 337
SEQ ID NO:645	CCAAAGGAACGGGAGGATCCCTA	358 - 380
SEQ ID NO:646	CTTACAGAAAAGTTTTCTGCACAAC	409 - 433

Each dot on the carrier 11 is an oligonucleotide selected from Tables 1 to 36. For example, an oligonucleotide on the carrier 11 could be selected from one of the sequences numbered SEQ ID NO: 1 to SEQ ID NO 24(shown in Table 1) for indentifying the subtype 11 of human papilloma viruses (HPV 11).

The method for mounting the oligonucleotides on the carrier 11 (the nylon membrane) is described as follows.

1.-TTTTTTTTTTTTTTT (SEQ ID NO: 647) is added to the 3' end of the oligonucleotide provided by the present invention by terminal transferase according to the following steps 1.1 to

10 1.3.

1.1 Mixing the following components:

10X NEBuffer 4	5 μ l
2.5 mM CoCl ₂	5 μ l
oligonucleotide	5 ~ 300 pmol
10 ~ 300 mM dATP 、dCTP 、dTTP or dGTP	1 μ l
Terminal Transferase (20U/ μ l) (NEW English BioLabs,M0252S)	0.5 ~ 5 μ l

Add M.Q. H ₂ O to final volume	50 μ l
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1.2 The components are mixed at 37°C for 15~60 minutes.

1.3 10 μ l of 0.2 M EDTA (pH 8.0) is added to the mixture to stop the reaction.

2. The oligonucleotide having 3' end labeling is mounted on the carrier 11 according to the following steps 2.1 to 2.3.

2.1 The oligonucleotide having 3' end labeling is mounted on the carrier 11 by a needle having a 400 μm wide head. The distance between each dot is 1200 μm .

5 2.2 The carrier 11 having the dot array 12 thereon is exposed to UV light, and the detector 10 is formed.

2.3 The detector 10 is preserved in a drying box.

Please refer to Fig. 2. A detector 20 is the second embodiment of the present invention for simultaneously detecting and identifying subtypes of human papilloma viruses contained in a sample. The detector 20 includes a carrier 21 and a dot array 22. The carrier 21 is a glass plate
10 having the dot array 22 mounted thereon. Each dot in the dot array 12 is an oligonucleotide (15~30mer) for identifying a specific subtype of human papilloma viruses.

Each dot on the carrier 21 is an oligonucleotide selected from Tables 1 to 36. For example, an oligonucleotide on the carrier 21 could be selected from one of the sequences numbered SEQ
15 ID NO: 1 TO SEQ ID NO: 24 (shown in Table 1) for indentifying the subtype 11 of human papilloma viruses (HPV 11).

The method for mounting the oligonucleotides on the carrier 21 (the glass plate) is described as follows.

1. The surface of the carrier 21 is treated according to the following steps 1.1 to 1.8.

20 1.1 The carrier 21 is cleaned in non-fluorescent and soft cleaner.

1.2 The clean carrier 21 is immersed in 10% NaOH.

1.3 The carrier 21 is oscillated in double-distilled water, 1% HCl solution and methanol in sequence for 2 minutes, and dried in an oven.

1.4 The carrier 21 is immersed in 1% 3-aminopropyltrimethoxysilane (APTMS) in 95%
25 aqueous acetone at room temperature for about 2 minutes.

1.5 The carrier 21 is washed in acetone, and the carrier 21 is dried in the oven at 110°C for 45 minutes.

1.6 The dried carrier 21 is immersed in 0.2% 1,4-phenylene diisothiocyanate, wherein the solvent is 10% pyridine in dimethyl formamide), at room temperature for 2 hours.

1.7 The carrier 21 is washed in methanol and acetone, and then the carrier 21 is dried.

1.8 The dried carrier 21 is preserved in a vacuum and dry box.

5 2. The oligonucleotides provided by the present invention are mounted on the carrier 21 (the glass plate) according to the following steps 2.1 to 2.3.

2.1 The oligonucleotide having 3' end labeling is mounted on the carrier 21 by a needle having a 400 μm wide head. The distance between each dot is 1200 μm .

2.2 The carrier 21 is immersed in 1% NH_4OH solution for about 2 minutes, washed in
10 double-distilled water, and then dried at room temperature. Thus, the detector 20 is formed.

2.3 The detector 20 is preserved in a dried box.

The method provided by the present invention for simultaneously detecting and identifying subtypes of human papilloma viruses contained in a sample is described as follows.

1. The sample is treated according to the following steps 1.1 to 1.3.

15 1.1 The cells are centrifuged at 1,500 rpm at 20°C for 5 minutes.

1.2 The cell pellet is washed in 10 mM Tris (pH 8.5) and dissolved in 8 mM NaOH. Then, the solution is transfer to 1.5 mL micro-tube.

1.3 A proper amount of TreTaq (1U/ μl) solution is added to the micro-tube. The reaction is carried out at 95°C for 1 hour. The DNA contained in the sample is obtained after
20 centrifugation at 13,500 rpm, 20°C for 5 minutes. The otained DNA is preserved at -20°C.

2 Polymerase chain reactions are performed according to the following steps.

2.1 Glutaldehyde-3-phosphodehydrogenase gene is used as the internal control of the polymerase chain reactions according to the following steps 2.1.1 to 2.1.3.

2.1.1 Mixing the following components:

Reagent	Stock	amount	Final concentration
Sterile H_2O		2.6	
10X <i>Taq</i> Buffer		0.5	1X <i>Taq</i> Buffer

dNTP	2.5 mM	0.4	200 μ M
Template		1	
GAP241-5 ¹⁾ primer	10 pmol/ μ l	0.2	0.4 pmol/ μ l
GAP241-3 ²⁾ primer	10 pmol/ μ l	0.2	0.4 pmol/ μ l
ProTaq	5 U/ μ l	0.1	0.1 U/ μ l
(PROTECH)			
Total volume (μ l)		5	

1) Gap21-5 (SEQ ID NO: 648): CCACCAACTGCTTAGCACCCC

2) Gap21-3 (SEQ ID NO: 649): TGCAGCGTACTCCCCACATCA

3) The proper amount of mineral oil is added to prevent the evaporation.

2.1.2 The polymerase chain reaction is performed according to the following programs.

Program 1	Program 2	Program 3
	94°C , 15 seconds	
94°C ,	57°C ,	72°C ,
3 minutes	1 minute	5 minutes
	72°C , 30 seconds	
	40 cycles	

5

2.1.3 The product of the polymerase chain reaction is analyzed in 2.5% agarose/EtBr (0.5 \times TBE).

2.2 The DNA contained in the sample is proceeded the first round of polymerase chain reaction according to the following steps.

10 2.2.1 Mixing the following components:

Reagent	Stock	Amount	Final concentration
Sterile H ₂ O		4.7-5.7	
10X <i>Taq</i> Buffer		1	1X <i>Taq</i> Buffer
dNTP	2.5 mM	0.8	200 μ M
Template		1-2	

BSA	10 mg/ml	0.1	0.1 µg/µl
Primer ^{1,2)}	10 pmol/µl	0.6	0.6 pmol/µl
Primer ^{1,2)}	10 pmol/µl	0.6	0.6 pmol/µl
ProTaq (PRO _{TECH})	5 U/µl	0.2	0.1 U/µl
Total volume		10	
(µl)			

1) MY09/MY11 : Manos *et al.*, *Cancer Cells* 1989, 7, 209-214 ;

2) E1 301L/E1 847R : Ylitalo *et al.*, *J. Clin. Microbiol.* 1995, 33, 1822-1828 ;

3) The proper amount of mineral oil is added to prevent the evaporation.

2.2.2 The polymerase chain reaction is performed according to the following programs.

Program 1	Program 2	Program 3
94°C , 45 seconds		
94°C ,	45°C ,	72°C ,
3 minutes	1 minute	5 minutes
	72°C ,	
	1.5 minutes	
45 cycles		

5 2.2.3 The product of the polymerase chain reaction is analyzed in 2.5% agarose/EtBr (0.5×TBE).

2.3 The DNA contained in the sample is proceeded the second round of polymerase chain reaction via internal primers according to the following steps.

2.3.1 Mixing the following components:

Reagent	Stock	Amount	Final concentration
Sterile H ₂ O		11.75	
10X <i>Taq</i> Buffer		2.5	1X <i>Taq</i> Buffer
dNTP	2.5 mM	2	200 µM
First round PCR product		5	

BSA	10 mg/ml	0.25	0.1 µg/µl
Primer ¹⁾	10 pmol/µl	1.5	0.6 pmol/µl
Primer ^{1,2,3)}	10 pmol/µl	1.5	0.6 pmol/µl
ProTaq (PRO _{TECH})	5 U/µl	0.5	0.1 U/µl
Final volumn (µl)		25	

1) GP5+/GP6+ : De Roda Husman *et al.*, *J. Gen. Virol.* 1995, 76, 1057-1062 ;

2) E1 350L/E1 547R : Ylitalo *et al.* *J. Clin. Microbiol.* 1995, 33, 1822-1828 ;

3) The 5' end of the GP6+ and E1 547R primers could be labeled with biotin or Cy5 fluorescent substances.

5 4)The proper amount of mineral oil is added to present the evaporation.

2.3.2 The polymerase chain reaction is performed according to the following programs.

Program 1	Program 2	Program 3
	94°C ,	
	45 seconds	
94°C ,	45°C ,	72°C ,
3 minutes	1 minute	5 minutes
	72°C ,	
	1.5 minutes	
	45 cycles	

2.3.3 The product of the polymerase chain reaction is analyzed in 2.5% agarose/EtBr (0.5×TBE).

10 3. The detector 10 provided by the present invention is used for identifying the subtypes of human papilloma viruses according to the following steps.

3.1 The detector 10 is immersed in 2x SSC solution for 5 minutes.

3.2 The detector 10 is immersed in a buffer containing salmon sperm DNA (50 µg/µl), and the oligonucleotides mounted on the detector 10 are pre-hybridized with the salmon sperm DNA at 35°C for 30 minutes.

15 3.3 The PCR product having biotin labeled thereon is added into and mixed with a buffer containing salmon sperm DNA (50 µg/µl) at 95°C for about 5 minutes. The denatured DNA is

placed on ice.

3.4 The denature DNA is added to the detector 10 and hybridized with the oligonucleotides at 35°C for 4 hours or overnight.

3.5 The detector 10 is washed in 2x SSC/1% SDS solution at 35°C for 15 minutes.

5 3.6 The detector 10 is washed in 0.2x SSC/0.1% SDS solution at 35°C for 15 minutes.

3.7 The detector 10 is treated in 0.5% isolation reagent for 1 hour.

3.8 The detector 10 is treated with avidin-alkalinephosphatase for about 1 hour.

3.9 The detector 10 is washed in 1x PBST solution.

3.10 The detector 10 is washed in Tris/NaCl solution.

10 3.11 The detector 10 is treated with NBT/BCIP at room temperature to show the reacting dot in blue.

3.12 The blue dot having the specific oligonucleotide sequence presents the specific subtype of human papilloma viruses contained in the sample.

15 4. The detector 20 provided by the present invention is used for identifying the subtypes of human papilloma viruses according to the following steps.

4.1 The PCR product having Cy5 labeled thereon is purified by PCR Clean Up-M System (Viogene, USA), and the PCR product is precipitated in ethanol. Then, the PCR product is dried.

20 4.2 The precipitated DNA is dissolved in 12 µl of the buffer (2x SSC/0.1% SDS), and centrifugated for 1 minute, and then placed on boiled water for 2 minutes. Then, the mixture is placed on ice for 5 minutes.

25 4.3 The mixture is centrifugated for 30 seconds, and 10 µl of the mixture is added to the left side of the dot array 22. A cover slice is carefully covered on the dot array from the left side of the dot array to prevent the bubble formation. Then, the detector 20 is place in Humid Chamber (Sigma, USA), and the dot array is faces downward at 35°C for 4 hours or overnight.

4.4 The detector 20 is vertically placed in the solution A (2x SSC/1% SDS), and the detector is slightly oscillated apart from the cover slice. Then, the detector 20 is washed in a shaker at 160 rpm for 12 minutes.

30 4.5 The detector 20 is washed in the solution B (0.2x SSC/0.1% SDS) and oscillated at 35°C for 12 minutes. The detector 20 is washed in water. Then the detector 20 is dried.

4.6 The dried detector 20 is scanned by GenePixTM4000 (Axon, USA), excited by the light having 635 nm of wavelength, and analyzed by GenePixPro 3.0 (Axon, USA).

Please refer to Figs. 3(a) and (b). Fig. 3(a) is a schematic view showing the third embodiment of the present invention. The detector 30 provided by the present invention is used for simultaneously detecting and identifying subtypes of human papilloma viruses contained in a sample. The detector 30 includes a carrier 31 and a dot array 32.

The carrier 31 is a nylon membrane. The actual length of the nylon membrane is about 1.44 cm and the actual width of the nylon membrane is about 0.96 cm. The dot array is mounted on the carrier 31 according to the foresaid method, wherein the distance between each dot is about 1.2 mm and the diameter of each dot is about 0.4 mm. Each dot is an oligonucleotide (15~30mer), and each oligonucleotide is used for specifically identifying a subtype of human papilloma viruses. The sequence of the oligonucleotide is selected from the Tables 1 to 36.

The subtype of human papilloma viruses identified by each dot of the dot array 32 is illustrated in Fig. 3(b). SC (system control) presents the PCR product amplified from any subtype of human papilloma viruses and biotin-contained primer. NC (negative control) presents the plants DNA fragment irrelevant to HPV. IN (internal control) presents the sequence 5'-gccagactgtgggtggcag-3' (SEQ ID NO: 650) of the housekeeping gene, Glyceraldehyde-3-Phosphate Dehydrogenase (GAP-DH).

The plural detector 30 are used for identifying positive clones of human papilloma viruses according to the foresaid method, and the results are shown in Figs. 4(a) to (c). The positive clones are respective amplified by using MY11/MY09 primers and the first round of polymerase chain reaction. The products of the first polymerase chain reaction are analyzed in 2.5% agarose/EtBr, and the electrophoresis results are shown in Fig. 4(a). The products of the first round polymerase chain reaction are respective amplified by using GP5/GP6 primers and the second round of polymerase chain reaction. The products of the second polymerase chain reaction are analyzed in 2.5% agarose/EtBr, and the electrophoresis results are shown in Fig. 4(b). The numbers labeled in Figs. 4(a) and (b) and the corresponding HPV clones are illustrated in Table 39.

Table 39

NO:	HPV clone	NO:	HPV clone	NO:	HPV clone
M	DNA marker	7	HPV 33	14	HPV 56
1	HPV 6	8	HPV 35	15	HPV 59
2	HPV 11	9	HPV 44	16	HPV 61
3	HPV 16	10	HPV 45	17	HPV 66
4	HPV 18	11	HPV 52	18	HPV 70
5	HPV 26	12	HPV 53	19	HPV CP8061
6	HPV 31	13	HPV 54	20	HPV L1AE5

The foresaid products numbered 1 to 20 of the second polymerase chain reactions are respectively detected by the detectors 30, and the results are shown in Fig. 4(c). According to the comparison between the results shown in Fig. 4 (c) and Fig. 3(b) based on the "SC" dot, the detector 30 provided by the present invention is used for precisely identifying the subtype of human papilloma viruses. Furthermore, no cross reactions occur in the detection.

In addition, the detectors 30 are used for detecting and identifying the subtypes of human papilloma viruses contained in a sample, and the results are shown in Fig. 5. According to the comparison between the results shown in Fig. 5 and Fig. 3(b) based on the "SC" dot, HPV 53 is contained in the sample (1), HPV 45 is contained in the sample (2), HPV 52 is contained in the sample (3), and HPV 39 is contained in the sample (4).

Please refer to Figs. 6(a) and (b). Fig. 6(a) is a schematic view showing the fourth embodiment of the present invention. The detector 40 is used for simultaneously detecting and identifying the subtypes of human papilloma viruses contained in a sample. The detector 40 includes a carrier 41 and a dot array 42. The carrier 41 is a glass plate, and the dot array 42 is mounted on the glass plate according to the foresaid method. Each dot is an oligonucleotide (15~30mer) for specifically identifying a subtype of human papilloma viruses. The sequences of the oligonucleotides are selected from Tables. 1 to 36. The subtype of human papilloma viruses identified by each dot of the dot array 42 is illustrated in Fig. 6(b).

The detector 40 is stained with SYBR Green II, scanned by GenePixTM 4000 (Axon, USA) and excited by the light having 635 nm of wavelength. The result is shown in Fig. 7(a).

In addition, the positive clones of HPV 11 and HPV 18 are respectively treated with two rounds of polymerase chain reactions, and the products of the polymerase chain reactions are

respectively analyzed by the detectors 40. The results are shown in Fig. 7(b), wherein the red fluorescent dot presents positive result. According to the comparison between the results shown in Fig. 7(b) and Fig. 6(b), the detector 40 provided by the present invention is used for precisely identifying the subtype of human papilloma viruses. Furthermore, no cross reactions occur in the
5 detection.

While the invention has been described in terms of what are presently considered to be the most practical and preferred embodiments, it is to be understood that the invention need not be limited to the disclosed embodiment. On the contrary, it is intended to cover various modifications and similar arrangements included within the spirit and scope of the appended
10 claims which are to be accorded with the broadest interpretation so as to encompass all such modifications and similar structures. Therefore, the above description and illustration should not be taken as limiting the scope of the present invention which is defined by the appended claims.